Active Project (2012 - 2017)

Carbon Nano-Tube (CNT) Reinforced COPV Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)

ANTICIPATED BENEFITS

To NASA funded missions:

Reduced COPV mass for small satellites.

To other government agencies:

Reduced COPV mass for small satellites

To the commercial space industry:

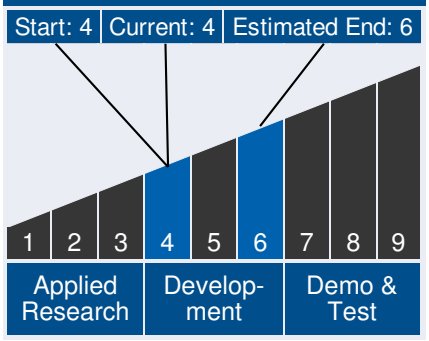
Reduced COPV mass for small satellites

DETAILED DESCRIPTION

Reduce the structural mass of future aerospace vehicles through the development of ultra lightweight materials and structures through the use of: Carbon nanotube reinforcements and composites, Ultralightweight core materials for efficient load bearing composite sandwich structures, mature technologies and demonstrate benefits through a combination of ground and flight tests.

Table of Contents

Technology Maturity



Management Team

Program Executive:

- Lanetra Tate

Program Manager:

- Mary Wusk

Continued on following page.

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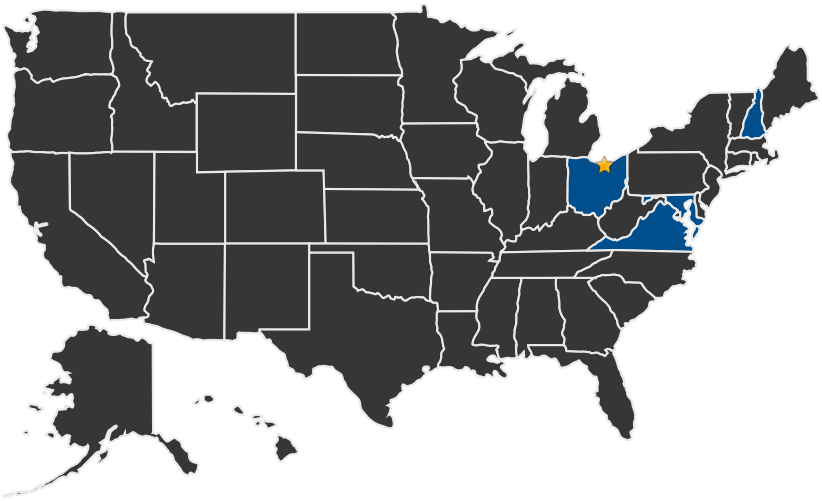
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Management Team *(cont.)*

Project Manager:
- Azlin Biaggi-labiosa

Principal Investigator:
- Peter Lillehei

Co-Investigator:
- John Thesken

Technology Areas

Primary Technology Area:
Nanotechnology (TA 10)
- Engineered Materials and Structures (TA 10.1)
  - Lightweight Structures (TA 10.1.1)
    - Nanotube Reinforced Structural Composite (TA 10.1.1.1)
- Energy Storage, Power Generation, and Power Distribution (TA 10.2)
  - Power Distribution (TA 10.2.3)
    - Carbon Nanotube Based Power and Avionics Cables (TA 10.2.3.1)

Continued on following page.

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Technology Areas *(cont.)*

Secondary Technology Area:

- Nanotechnology (TA 10)
  - Sensors, Electronics, and Devices (TA 10.4)
- Materials, Structures, Mechanical Systems and Manufacturing (TA 12)
  - Materials (TA 12.1)
    - Lightweight Structural Materials (TA 12.1.1)
      - Out Of Autoclave Material Systems Resins/Adhesives/Fibers (TA 12.1.1.1)

Additional Technology Areas:

- Nanotechnology (TA 10)
  - Sensors, Electronics, and Devices (TA 10.4)
    - Sensors and Actuators (TA 10.4.1)
      - High Performance Radiation Sensors (TA 10.4.1.2)
      - Gas and Vapor Sensors (TA 10.4.1.4)
    - Nanoelectronics (TA 10.4.2)
      - 1D Nanoelectronics (TA 10.4.2.6)
    - Miniature Instruments and Instrument Components (TA 10.4.3)
      - Portable Integrated Medical Diagnosis Tool for Long-Duration Human Spaceflight (TA 10.4.3.5)

DETAILS FOR TECHNOLOGY 1

Technology Title

Nanotechnology: CNT Reinforced COPV Flight Test

Technology Description

This technology is categorized as a hardware component or part for unmanned spaceflight

•Develop ultralightweight, high strength composites from carbon nanotube reinforcements

- Targeting specific strength 1.5 to 2X that of conventional aerospace carbon fiber reinforced epoxy
- Estimate 30% reduction in launch vehicle total mass by using CNT composites in cryotank

•CNT reinforcements are available on commercial and developmental scales

- Primary application is for lightweight electrical cables
- Best reported mechanical properties are about ½ that of conventional carbon fiber, actual properties are much lower
- üheoretical studies (Cornwall and Welch) suggest that tensile strengths 12X that of conventional carbon fiber are possible through a combination of processing (longer, better aligned CNTs) and post-processing (cross-linking)

•Collaborating with industry, universities, DoD and NIST to improve tensile properties of CNT reinforcements and utilize them in composites

Capabilities Provided

Reduced COPV mass, improved durability and damage tolerance

Potential Applications

Small satellites, propulsion and attitude control systems